

The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Jim Snell, 301-903-4094, or Internet address jim.snell@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-22

May 23 through May 29, 1997

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EVENTS

1. RAPID OVER-PRESSURIZATION OF WASTE SHIPPING CONTAINER

On May 22, 1997, at Fernald, a waste shipping container ("white metal box") over-pressurized and ruptured, releasing some of its contents. An employee walking outside a storage warehouse heard an explosion-like sound and saw a flash of light from inside. Emergency Response Team members rushed to the scene. Two response team members dressed in protective clothing with self-contained breathing apparatus entered the warehouse and saw white smoke or dust coming from the white metal box. They left the building, then heard two additional explosion-like sounds coming from the area of the box. Other responders entered the building and discharged a dry chemical fire extinguisher into the box. They noticed that the color of the smoke coming from the box changed from white to yellow. Investigators believe that mixed incompatible waste material caused the over-pressurization. Responders established atmospheric monitoring stations and determined that there was no detectable spread of contamination and no significant release of airborne contaminants. After the smoke emissions decreased, responders moved the box out of the warehouse to a secure storage location. No one was injured, and equipment damage was limited to the white metal box. (ORPS Report OH-FN-FDF-FEMP-1997-0034)

Investigators determined that the white metal box contained low-level radioactive legacy waste. Waste handlers had packaged the box earlier in the week for shipment to the Nevada Test Site. The box contained five, 55-gallon drums of waste material without lids. Additional waste material was stored between the drums as filler (see figure 1-1). The box was on the bottom of a three-high stack of white metal boxes.

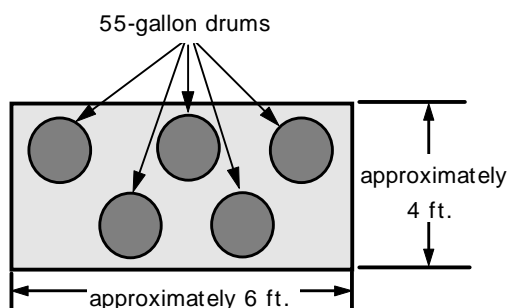


Figure 1-1 Top View of "White Metal Box"

Investigators determined that some of the waste in the box contained high concentrations of uranium nitrates, chlorides, and water. They believe that the over-pressurization was caused by a chemical reaction between wastes placed in the box. As an immediate corrective action, the facility manager suspended all site operations involving packaging of multiple waste streams. Between 1990 and 1997, Fernald workers shipped over 100,000 containers or approximately six and a half million cubic feet of waste to the Nevada Test Site. Department of Energy personnel notified Nevada Test Site personnel of the event and recommended evaluation of containers with similar waste streams. The facility manager also directed facility personnel to revise the procedure that controls packaging of residues to ensure that mixing of intermediate materials is addressed. Investigators continue to assess the event to determine the exact cause of the reaction. Lessons learned from this event include the importance of (1) not mixing incompatible materials, even if approved in a procedure; (2) evaluating materials; and (3) ensuring procedures govern the chemicals that can be packaged together to preclude unwanted interactions.

NFS reported chemical reaction events in Weekly Summaries 96-22, 96-15, 95-52, 95-24, 95-23, 95-04, 93-48, and 93-40. Weekly Summary 95-52 reported the lessons learned from an event at the Oak Ridge K-25 Facility. On October 14, 1995, a 5-gallon plastic container ruptured because of internal pressure from a chemical reaction. Although no one was injured, the force of the reaction and parts from the plastic container created a hole in the wall nearest the container and in the ceiling directly above it. The explosion occurred as a result of mixing nitric acid, acetone, and other organic waste. Lessons learned from the October 14, 1995, event indicate that procedures must clearly identify the possibility of mixing incompatible materials and the actions needed to ensure segregation of the chemicals. (DOE Lessons Learned List Server Item Number Y-1995-OR-LMES-K25-1201, ORPS Report ORO--LMES-K25-GENLAN-1995-0003)

These events highlight the need for managers of facilities that generate and receive waste materials containing chemicals to develop appropriate programs and procedures to identify chemical compatibility. These programs should consider safe handling, storage, and transportation requirements. Facility managers should ensure that workers are familiar with facility safety precautions and emergency procedures and should provide workers with the necessary information to ensure accurate compatibility evaluations. Hazardous chemicals must be identified and their risks understood. Risks should be evaluated, and barriers should be put in place to reduce them. In facilities where hazardous chemicals are processed, workers should be trained in handling chemicals and their potential reactions. Personal protective equipment must be selected in accordance with the magnitude of the hazard and training must be provided in the proper use of the equipment.

DOE/EH-0296, Bulletin 93-2, "Mixing of Incompatible Chemicals," includes a list of applicable regulations and guidelines. It also includes recommendations for preventing such events and protecting against the consequences should they occur. In February 1993, NFS issued DOE/NS-0013, Safety Notice 93-1, "Fire, Explosion, and High-Pressure Hazards Associated with Waste Drums and Containers," which describes lessons learned on safe storage and handling of waste containers and drums. The Notice specifically discusses handling, storing, venting, and opening containers suspected of being pressurized or containing flammable vapors. Both Safety Notice 93-1 and Bulletin 93-2 can be obtained by contacting the Info Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874.

KEYWORDS: chemicals, chemical reactions, drums, safety

FUNCTIONAL AREAS: Materials Handling/Storage, Industrial Safety

2. VENDOR REMOVES WRONG EQUIPMENT FROM DEACTIVATED BUILDING

On May 21, 1997, at the Savannah River Site, a Department of Energy vendor mistakenly removed operational equipment from a reactor material facilities building during disassembly and removal of surplus extrusion press equipment. The building custodian discovered that the control panel and power panel for the building exhaust fans were missing when he tried to start the fans. The vendor incorrectly included the two panels in a group of items identified as "associated equipment" that was targeted for removal along with the extrusion press. Removing the wrong equipment disabled the exhaust fans and will result in additional costs and man-hours to reinstall the equipment and verify proper operation. Fuel and target assemblies for Savannah River Site nuclear reactors were manufactured in the reactor materials facilities; workers are now decontaminating and decommissioning the facilities. (ORPS Report SR--WSRC-RMAT-1997-0006)

When the building custodian tried to start the building exhaust fans, he discovered the control panel had been removed from its installed location. He traced the electrical supply for the control panel and observed that the power panel had also been removed. After further investigation, he determined that the electrical supply to the missing equipment had been interrupted by a disconnect switch in the "OFF" position. The custodian directed an operator to install a hasp and lock to keep the disconnect in the "OFF" position until an investigation could be completed. The custodian later found the missing panels inside the building maintenance shop. The vendor's supervisor told the custodian they had removed the items on the afternoon of May 20, per instructions, and stored them on a pallet in the maintenance shop.

Investigators determined the cause of this event was inadequate identification of the associated equipment to be removed. Facility personnel assumed that identification of excessed equipment in the building would be obvious to the vendor. However, the vendor was confused because there were no labels or tags on the equipment. The vendor traced an electrical lead from a portion of the extrusion press to the control panel and incorrectly believed he was to remove the control panel and associated equipment. The vendor did perform zero-energy voltage checks on both panels before removing them.

Facility personnel performed a walk-down of the building and uniquely tagged every piece of equipment that was not already identified for removal. They also tagged surplus equipment in another building that has been deactivated. Facility personnel are evaluating the reinstallation effort for the exhaust fan control panel and power panel. Future use of the building requires that this equipment remain operational.

This event is important because of the increasing number of DOE facilities that are transitioning to deactivation and decommissioning activities. Managers at DOE facilities undergoing deactivation need to ensure that vendors understand what equipment has been approved for removal. This can be accomplished by (1) ensuring contract documents with vendors and subcontractors clearly define the scope of the work and accurately identify the equipment, (2) conducting walk-downs of the facility with the vendor, (3) marking or tagging the equipment to be removed, and (3) checking the removed equipment against an inventory list. Managers should review their administrative work controls because of the many configuration changes that take place during decommissioning. Work controls are important during decommissioning because the work force is usually not familiar with plant structures, systems, and components. DOE-STD-1073-Pt.1, *Guide for Operational Configuration Management Program*, section 1.4.2.3, states that managers of facilities in a deactivation mode should track changes and provide documentation of the structures, systems, and components that remain in the facility. Limited walk-downs of the facility should be conducted to confirm that the configuration shown on the associated documentation is accurate. Physical changes should be identified and documented.

KEYWORDS: equipment, labeling, decontamination and decommissioning, work control

FUNCTIONAL AREAS: Decontamination and Decommissioning, Work Planning

3. **DEPARTMENT OF ENERGY AND TWO HANFORD CONTRACTORS RECEIVE PROPOSED NOTICE OF PENALTY**

On April 28, 1997, the State of Washington Department of Ecology assessed a proposed \$90,000 penalty against the Department of Energy (DOE), Fluor Daniel Hanford, and Rust Federal Services of Hanford Inc., for failure to maintain control of waste accumulated at the Hanford Analytical Laboratory. DOE and the contractors agreed to revise the waste control procedures following a September 13, 1996, event in which acid was expelled from a pressurized chemical waste bottle in the Laboratory. On February 3, 1997, Hanford managers reported to the Department of Ecology that commitments made as a result of the September 13 event were completed. Representatives of the Department of Ecology inspected the Laboratory on February 13 and concluded that the problems had not been corrected. Rust Federal Services managers have notified the Department of Ecology that they will appeal the proposed penalty. (ORPS Report RL--PHMC-ANALLAB-1997-0014)

On September 13, 1996, at the Analytical Laboratory, a chemical technologist working in a fume hood heard a pressure release and noticed yellow smoke and a liquid spray coming from a bottle of mixed waste materials in a nearby fume hood. The technologist immediately exited the room, closed the doors, and notified the laboratory leader. The Hanford Hazardous Material Response Team and the site spill/release contact responded to the event. No one was injured. The final occurrence report stated that the root cause was the lack of a clearly defined chemical waste collection/disposal process for waste generated from analytical procedures. Corrective actions for the event included enhancing laboratory procedures, retraining laboratory personnel, and reclassifying laboratory fume hoods as satellite accumulation areas. Laboratory managers included implementation of these corrective actions as part of their commitment to the Department of Ecology. (ORPS Report RL--WHC-ANALLAB-1996-0035)

On October 1, 1996, a new management team that included Fluor Daniel and Rust Federal Services assumed control of the Analytical Laboratory. The new team directed a major rewrite of Laboratory procedures and retrained 150 chemists and technicians. Since October 1, there have been no personnel safety incidents related to waste management practices and no instances where waste has been improperly identified and disposed.

This is the sixth time since 1992 that the Department of Ecology has fined Hanford; the first under the new Fluor Daniel team. Including the proposed \$90,000 penalty, the fines total \$237,500.

NFS reported previous Department of Ecology fines against Hanford contractors and DOE in Weekly Summaries 96-41, 96-04, and 95-23. Weekly Summary 96-41 reported on a \$20,000 penalty assessed against Westinghouse Hanford Company and DOE for failing to correct violations discovered during inspections performed in September 1995 and June 1996. The penalty was based on the failure to correct a finding involving a violation of Washington State requirements. The violation cited was for failure to designate solid waste as "Dangerous Waste" and failure to properly segregate incompatible waste types. (ORPS Report RL--PHMC-GENERAL-1996-0015)

Weekly Summary 96-41 also reported that Operating Experience Analysis and Feedback engineers reviewed the Occurrence Reporting and Processing System database and found 93 events DOE-wide where violations were issued by regulatory agencies. Activities involving discharges to the environment, waste management, or waste disposal comprised 74 of the 93 violations. Sixteen of these violations resulted in fines totaling in excess of \$1 million.

These events highlight the increasing scrutiny that state and local regulatory agencies are placing on DOE facilities and the importance of ensuring that programs that implement corrective actions are effective. Failure to comply with state and local regulations or to take effective corrective actions may result in citations, violations, and fines.

KEYWORDS: dangerous waste, environmental, penalty, violation

FUNCTIONAL AREAS: Environmental Protection, Industrial Safety, Materials Handling/Storage

4. INADVERTENT CRITICALITY AT RUSSIAN FACILITY

On May 15, 1997, a criticality excursion occurred at the Khimkontsentraty (Chemical Concentrations) factory in Novosibirsk, Russia. The facility produces highly enriched uranium fuel rods for 13 plutonium production reactors. The criticality excursion occurred in a tank located in a room that is normally unoccupied. Operators responding to radiation alarms heard popping sounds and discovered radiation levels as high as 10 rem/hr at a distance of 0.5 m from the tank. They added 50 liters of boric acid, a strong neutron absorber, to the tank to stop the chain reaction. Criticality accidents can result in high radiation exposures and fatalities.

Information on this event is incomplete and contradictory. Operating Experience Analysis and Feedback (OEAF) engineers have attempted to present the available information as accurately as possible in the following summary.

After radiation levels in the area had subsided, operators drained a portion of the solution in the tank into long, thin, 5-liter polyethylene bottles to make room for more boric acid. The Russian Nuclear Ministry indicated that (1) radiation levels throughout most of the plant and outside the plant remained at background levels, (2) all personnel received medical examinations, (3) no one was injured or contaminated, and (4) there was no release of radioactivity to the environment. However, other reports indicate that some workers may have been seriously exposed or contaminated.

The excursion occurred in a tank with a slab configuration, 3 m by 2 m by 10 cm, located in a room that is normally unoccupied. It is believed that the tank was designed to be used for pickling or etching research reactor fuel, but apparently it was being used in a process involving unirradiated nuclear scrap and liquid. The maximum enrichment of the uranium in the tank is 26 percent.

The Russian Nuclear Regulatory Authority (GAN) attributes the excursion to a plugged drain that restricted the flow out of the tank. GAN identified the tank as a dissolver tank. OEAF engineers surmise that the plugged drain caused the liquid level to rise, and the increase in volume resulted in the criticality. Improper use of equipment for an unauthorized purpose without an adequate safety review may have contributed to the accident.

Engineers believe that criticality accidents of this type are not possible at operable Department of Energy (DOE) units. Units where similar operations take place across the DOE complex are designed to be geometrically safe. They have either a small enough diameter or volume to ensure that no criticality can occur, regardless of the concentration and enrichment of fissile material in the tanks.

DOE O 420.1, *Facility Safety*, section 4.3, describes criticality safety requirements for DOE facilities. The major principles emphasized in the Order are double contingency, geometry control, and application of bias. Double contingency is the principle that at least two unlikely, independent, and concurrent changes in process conditions must occur before a criticality

accident is possible. Geometry control is the use of enforced physical separation of fissile materials such that criticality cannot occur. Bias is the assumption that the neutron multiplication factor has the largest value allowed by uncertainties in calculations and experimental results. DOE units are designed to preclude criticality even in the presence of the largest neutron multiplication factors.

The Operating Experience Weekly Summary will provide updates on this accident as more information becomes available.

Keywords: Criticality, Criticality Safety

Functional Areas: Nuclear/Criticality Safety

FINAL REPORT

1. FAILURE OF UNDER-VOLTAGE RELAYS

This week Operating Experience Analysis and Feedback Engineers reviewed a final occurrence report about under-voltage relays that failed to actuate during testing. On December 11, 1996, at Los Alamos National Laboratory, workers testing equipment as part of the transfer to a new facility control system discovered that all three electrical high-speed bus transfer devices failed to switch to the secondary 13.2 kV electrical power source upon loss of primary power. They determined the switches failed to transfer power because the under-voltage relays connected to them did not actuate as designed. This event is significant because the relays had reached their end-of-life and were not in the preventive maintenance program. (ORPS Report ALO-LA-LANL-TA55-1996-0058)

The transfer to a new control program required personnel to test the electrical distribution system. They terminated primary 13.2 kV electrical power and observed the high-speed transfer switches to ensure they switched to secondary 13.2 kV power. The power supply has two, 13.2 kV electrical feeders (one primary and one secondary) that supply the facility; three sub-stations and associated high-speed transfer switches provide a redundant system. During the test, all three high-speed transfer switches failed to switch automatically to the secondary electrical feeder. This resulted in a 17-minute loss of power. However, operators could still switch to secondary power manually.

The final report identifies the root cause of this event as a management problem related to work organization/planning deficiency. Equipment aging and failing to compensate for the supply voltage settings contributed to the failure of the relays. The under-voltage relays were installed 1976, but they were not included in the maintenance program for replacement and their life expectancy was not determined. However, all three relays failed after about 20 years.

The facility manager directed his staff to perform the following corrective actions.

- Replace the under-voltage relays in all three high-speed transfer switches.
- Test the high-speed transfer switches after replacing the relays to ensure that they transfer power as required.
- Add the under-voltage relays to the maintenance program to ensure they are replaced before their end-of-life.

This event underscores the importance of maintenance personnel knowing the life expectancy of equipment, as well as the importance of ensuring inclusion of equipment in a maintenance program that allows for replacement before failure. DOE-STD-1073-93, *Guide for Operational Configuration Management Program*, discusses the importance of conducting aging-degradation evaluations and determining the present material condition of each component. DOE 4330.4B, *Maintenance Management Program*, discusses establishing effective programs for the management and performance of effective maintenance and repair. Section 5.2 of the Order addresses planned preventive maintenance to ensure equipment operates within the designed operating conditions. The Order includes guidance for incorporating vendor recommendations to predict component degradation and allow for replacement before failures.

KEY WORDS: preventive maintenance, electrical, configuration control

FUNCTIONAL AREAS: Configuration Control, Electrical Maintenance